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Can optical absorption lines be observed in the spectra of X-ray Novae?

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Abstract

Synthetic optical spectra and equivalent widths of a number of absorption lines in the spectra of accretion α disks of various luminosity (0.5-0.001 of the Eddington luminosity) around black holes with masses 1.44-10 M⊙ are calculated. The effect of self-irradiation of the disk is taken into account. The local spectra of the disk are treated as the spectra of stars with the same Teff and logg at the surface if the flux incident on the surface of a given ring is lower than its own flux; otherwise, the local spectrum is considered to be blackbody. The dependence of line equivalent widths on disk-accretion parameters and variations in the incident-to-own flux ratio along the disk radius are analyzed. The applicability of the technique is critically assessed, and it is shown that one might expect to detect absorption wings of the hydrogen Balmer lines in the brightness-decline phase of an X-ray nova outburst, when the disk luminosity is equal to 5-10% of the Eddington luminosity. The lower limit on the mass of the central object can be estimated from the equivalent width of an absorption component.